भारतीय मानक
IS 17955 : 2023

Indian Standard

[*Superseding IS 8419 (Part 1) : 1977*]

छनन माध्यम के रूप में उपयोग के लिए रेत और बजरी — विशिष्टि

Sand and Gravel for Use as Filtration Medium — Specification

ICS 91.140.60

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November 2023 **Price Group 5**

Public Health Engineering Sectional Committee, CED 24

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Public Health Engineering Sectional Committee had been approved by the Civil Engineering Divisional Council.

Sand and gravel are often employed as filter media for filtration of water. For their proper functioning it is necessary that they should satisfy certain physical and chemical requirements. This standard covers requirements for filter sand and gravel used in filtration of water. Other media which are also used for filtration of water are not covered under this standard.

IS 8419 (Part 1) : 1977 'Requirements for filtration equipment: Part 1 Filtration media — Sand and gravel' was formulated to cover requirements for sand and gravel for use as filtration medium for treatment of water. Subsequently, IS 8419 (Part 2) : 1984 'Requirements for rapid sand gravity filtration equipment: Part 2 Underdrainage system' was formulated in 1984 to cover requirements for underdrainage system for rapid sand gravity filtration equipment. Considering that IS 8419 (Part 1) did not specifically cover requirements of sand and gravel filtration medium for rapid sand gravity filters, it was decided by the technical committee responsible for the formulation of this standard to prepare a new standard for covering requirements of filter sand and gravel as presently covered in IS 8419 (Part 1) thereby superseding it. Accordingly, the specification for sand and gravel for use as filtration medium has been covered in this standard. IS 8419 (Part 2) has been revised as IS 8419 : 2023 'Underdrainage system of rapid sand gravity filtration equipment — Requirements (*first revision*)'.

In this revision of the standard, experience gained over the years in the use of erstwhile IS 8419 (Part 1) has been utilized. Further, comprehensive amendment No. 1 to IS 8419 (Part 1) : 1977 which was issued in 2020 to cover requirements for manufactured filter sand and gravel has been incorporated. Thus, in this standard, the following major modifications have been incorporated:

a) Manufactured filtration sand and gravel which are supplied in bags/packaged form have been covered;

b) Reference to the Indian Standard to be utilized for testing specific gravity of filter sand and gravel has been included;

c) Effective size and uniformity coefficient of filter sand and gravel for rapid sand gravity filter and slow sand filter have been specified;

d) Provisions on supplier's/manufacturer's certificate, delivery and marking including BIS certification marking have been included;

e) Tolerance on temperature conditions specified for various tests have been provided; and

f) The cross-referred standards which have since been revised have been updated;

The composition of the Committee responsible for the formulation of this standard is given in Annex D.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 2022 'Rules for rounding off numerical values (*second revision*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard

Indian Standard

SAND AND GRAVEL FOR USE AS FILTRATION MEDIUM — SPECIFICATION

1 SCOPE

This standard lays down the requirements for filter sand and gravel used in filtration of water.

2 REFERENCES

The standards given below contain provisions, which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreement based on these standards are encouraged to investigate the possibility of applying the most recent edition of these standards.

IS No.	*Title*
IS 878 : 2008/ ISO 4788 : 2005	Laboratory glassware — graduated measuring cylinders (*second revision*)
IS 2000 (Part 2) : 1985	Methods of chemical analysis of bauxite: Part 2 Determination of silica (*first revision*)
IS 2386 (Part 3) : 1963	Methods of test for aggregates for concrete: Part 3 Specific gravity, density, voids, absorption and bulking
IS 2720 (Part 4) : 1985	Methods of test for soils: Part 4 Grain size analysis (*second revision*)
IS 6365 : 1971	Specification for laboratory electric ovens
IS 8419 : 2023	Underdrainage system of rapid sand gravity filtration equipment — Requirements (*first revision*)
IS 11401 (Part 2) : 1990	General requirements for slow sand filter: Part 2 Design, construction, operation and maintenance

3 TERMINOLOGY

For the purpose of this standard, the following definitions shall apply.

3.1 Effective Size (E.S.) — Particle diameter corresponding to 10 percent finer on the grain size curve [determined according to IS 2720 (Part 4)].

3.2 Uniformity Coefficient — The ratio D60/D10 where D60 is the particle diameter corresponding to 60 percent finer on the grain size curve, and D10 is the particle diameter corresponding to 10 percent finer on the grain size curve.

4 FILTER SAND

4.1 Quality Requirements

4.1.1 Filter sand shall consist of hard and durable grains of silica with a specific gravity of not less than 2.5 when tested in accordance with IS 2386 (Part 3). All grains of sand shall preferably be water worn. The minimum silica content in sand as determined by the method given in IS 2000 (Part 2) shall be 90 percent.

4.1.2 Any sample of filter sand shall not contain more than 5 percent by volume of impurities, such as clay, loam, silt, etc, in one hour settlement after shaking in water in accordance with procedure described in Annex A.

4.1.3 The sand shall not contain more than 5 percent of acid soluble matter as determined by solubility test described in Annex B.

4.1.4 The loss on ignition, which is a measure of the organic matter present in sand, and determined by the procedure given in Annex C, shall not be more than 0.7 percent.

4.2 Grain Shape and Shape Variation

4.2.1 Shape of filter grains is important from the hydraulic and turbidity removal points of view. Rounded grains are preferable to angular ones.

4.2.2 Filter sand shall meet the requirements of effective size and uniformity coefficient as specified by the purchaser. The effective size of filter sand for use in rapid sand gravity filtration equipment (*see* IS 8419) shall be between 0.45 and 0.70 mm, and the uniformity coefficient shall be between 1.3 and 1.7. The requirements of filter sand for use in slow sand filters, including their effective size and uniformity coefficient shall be as specified in IS 11401 (Part 2).

4.3 Sampling

Sampling and criteria for conformity for filter sand maybe in accordance with **4.3.1** to **4.3.4**.

4.3.1 *Lot*

The quantity of sand received in a consignment from a single source shall be divided into a convenient number of lots of approximately equal size not exceeding 10 m^3.

4.3.2 From each lot, 10 increments each weighing about 2 kg shall be collected. The increment shall be taken at regular intervals during loading or unloading. From a stationary lot, 2 increments shall be taken from the top and 2 each from the four sides. The increment in all cases shall be taken from a depth of at least 150 mm.

4.3.3 All the increments taken from the same lot shall be mixed thoroughly and reduced by the process of coning and quartering to yield a laboratory sample of required mass (about 2 kg).

4.3.4 *Criteria for Conformity*

The laboratory sample as obtained in **4.3.3** shall be tested for all the requirements and if it passes in respect of them the lot shall be considered as conforming to this standard.

5 GRAVEL

5.1 Quality Requirements

5.1.1 Filter gravel shall consist of hard, preferably rounded stones with a specific gravity of not less than 2.5 when tested in accordance with IS 2386 (Part 3). Filter gravel shall be free from clay, sand, loam and organic impurities of any kind.

5.1.2 The gravel shall contain not more than 2 percent by mass of thin, flat or elongated pieces (in which the largest dimension exceeds three times the smallest dimension) determined by hand picking.

5.1.3 Gravel should be free from excessive amount of limestone or shells and acid solubility determined in accordance with procedure given in Annex B, should not exceed the following limits:

a) For gravel sizes 10 mm or larger : 10 percent solubility; and

b) For gravel sizes smaller than 10 mm : 5 percent solubility.

5.2 Sampling

Sampling and criteria for conformity for gravel shall be in accordance with **5.2.1** to **5.2.4**.

5.2.1 *Lot*

The quantity of gravel received in a consignment from a single source shall be divided into a convenient number of lots of approximately equal size not exceeding 25 m^3.

5.2.2 From each lot 25 increments each weighing about 5 kg shall be collected. The increments shall be taken at regular intervals during loading or unloading. From a stationary lot the increment shall be taken by a suitable method so as to represent the material in various locations of the lot.

5.2.3 All the increments taken from the same lot shall be mixed thoroughly and then reduced by the process of coning and quartering to yield a laboratory sample of about 5 kg.

5.2.4 *Criteria for Conformity*

The laboratory sample as obtained in **5.2.3** shall be tested for all the requirements. If it passes in respect of all of them, the lot shall be considered as conforming to this standard.

6 SUPPLIER'S/MANUFACTUER'S CERTIFICATE

The supplier/manufacturer shall furnish a certificate to the purchaser or his representative within ten days of dispatch of the filter sand/gravel stating that the material conforms to all the requirements of this standard.

7 DELIVERY

Supplies of filter sand/gravel may be made in bulk in suitable quantities mutually agreed upon between the purchaser and the supplier. Where so required by the purchaser, the filter sand/ gravel may be supplied in bags (jute, jute-laminated, polyethylene lined or as may be mutually agreed between the purchaser and the supplier) bearing the net quantity (may be 25 kg, 50 kg or as agreed to between the purchaser and the supplier).

8 MARKING

8.1 Each consignment/bag of filter sand/gravel shall be legibly and indelibly marked with the following information:

a) Manufacturers name and his registered trademark, if any;
b) Net quantity, in kg;
c) Address of the manufacturer;
d) Month and year of consignment/packing; and
e) Type of filtration media, such as 'filter sand' or 'filter gravel'.

8.2 Similar information shall be provided in the delivery advices accompanying the shipment of filter sand/gravel in bulk (*see* **7**).

8.3 BIS Certification Marking

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations framed thereunder, and the products may be marked with the Standard Mark.

ANNEX A

(*Clause* 4.1.2)

TEST FOR DETERMINIG IMPURITIES, SUCH AS CLAY, LOAM, SILT, ETC

A-1 PROCEDURE

Fill a 1 000 ml calibrated measuring cylinder (as per IS 878) with filter sand to be tested to half its volume and add water until the cylinder is three-fourths full. Shake up the mixture vigorously and allow it to settle for one hour.

A-2 REPORTING OF RESULT

Report the volume of impurities standing over the sand as percentage of volume of sand.

ANNEX B

(*Clause* 4.1.3 *and* 5.1.3)

ACID SOLUBILITY TEST

B-1 PROCEDURE

B-1.1 Rinse a minimum of 10 g of sample with distilled water to remove all dust and fine material, dry at (105 ± 2) °C in a hot air-oven conforming to IS 6365 for one hour, cool and weigh. Immerse in 40 percent (v/v) hydrochloric acid for a period of 24 hours at room temperature. After 24 hours of immersion, wash the sample thoroughly with distilled water, dry at 103 °C in hot air for one hour, cool and weigh.

B-1.2 The percentage of solubility is given by the formula:

$$\text{Solubility percent} = \frac{\text{Loss in weight}}{\text{Original weight}} \times 100$$

ANNEX C

(*Clause* 4.1.4)

LOSS ON IGNITION TEST

C-1 PROCEDURE

Rinse a minimum of 10 g of the sample with distilled water to remove dust and fine material, dry at (105 ± 2) °C in a hot air-oven conforming to IS 6365 for one hour, cool and weigh. Ignite the sample at (550 ± 10) °C in an electric muffle furnace for one hour, cool and weigh.

C-2 CALCULATION

C-2.1 Calculate percent loss on ignition using the following formula:

$$\text{Loss on ignition} = \frac{\text{Loss in weight}}{\text{Original weight of sample}} \times 100$$

ANNEX D

(*Foreword*)

COMMITTEE COMPOSITION

Public Health Engineering Sectional Committee, CED 24

Organization	*Representative(s)*
In Personal Capacity (*840, Sector-17, Faridabad - 121002*)	SHRI A. K. SARIN **(*Chairperson*)**
Bangalore Water Supply & Sewerage Board, Bengaluru	SHRI B. R. NAGENDRA SHRI GURUPRASSAD BAILY (*Alternate*)
Brihan Mumbai Licensed Plumbers Association, Mumbai	SHRI KISHOR MERCHANT SHRI BIJAL M. SHAH (*Alternate*)
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Central Pollution Control Board, New Delhi	SHRI P. K. MISHRA
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